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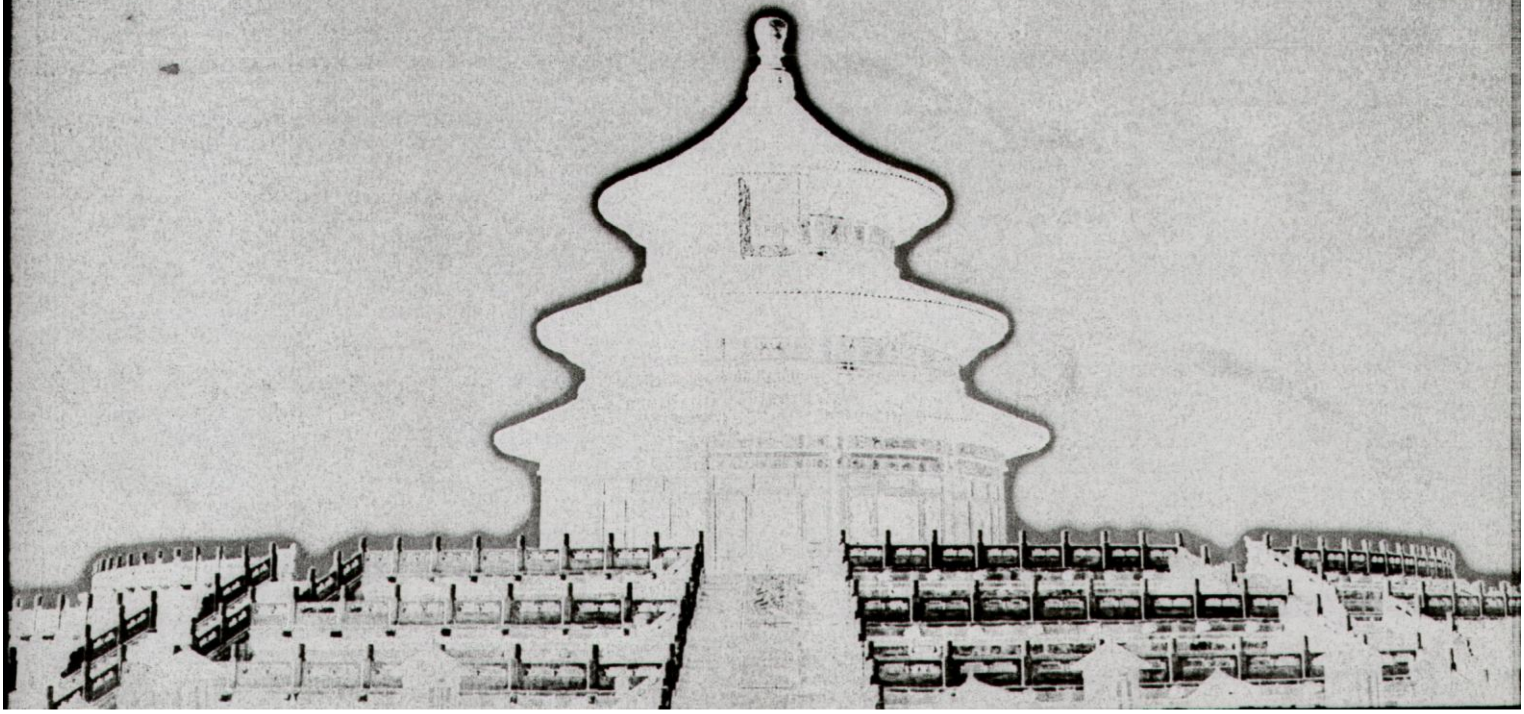

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property was measured. Details of the investigation will be reported in the paper.

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5P-2136

Synthesis and Characterization of Superparamagnetic Magnetite Nanoparticles

Oznur Karaagac[1,a] *, Seda Beyaz[2,b], Taner Tanrisever[2,c], Hakan Kockar[1,d]

[1]Department of Physics, Balikesir University, Balikesir 10145, Turkey

[2]Department of Chemistry, Balikesir University, Balikesir 10145, Turkey

[a]karaagac@balikesir.edu.tr,
[b]sedacan@balikesir.edu.tr,
[c]taner@balikesir.edu.tr,
[d]hkockar@balikesir.edu.tr

Keywords: Co-precipitation, Magnetite, Superparamagnetic nanoparticles

Abstract: Magnetic nanoparticles have been attracted a lot of interest because of their special properties that are characteristics of neither the atom nor the bulk counterparts. Especially, magnetite (Fe_3O_4) nanoparticles are interesting because of their biocompatibility and low toxicity in human body [1]. One of the most widespread techniques to synthesize magnetite is co-precipitation. In this study, magnetite nanoparticles were synthesized by co-precipitation technique using ferrous and ferric chloride salts with the ratio of 2/3 in air atmosphere. Two different base sources, ammonium hydroxide and sodium hydroxide, were used. The reaction was performed at room temperature under vigorous stirring. Magnetite nanoparticles can be synthesized over the concentration of 5.6 M for the bases. The structural analysis made by using x-ray diffraction technique (XRD) and fourier transform infrared spectroscopy showed that the product is magnetite. The particle sizes calculated from the most intense peak in the XRD pattern using the Scherrer equation were <22 nm for the ammonium hydroxide. Magnetic properties of magnetite nanoparticles investigated by vibrating sample magnetometer revealed that all samples are superparamagnetic. The decrease of the concentration of ammonium hydroxide results in the increase of the saturation magnetization, M_s, from 58 emu/g to 67 emu/g whereas M_s was almost constant ($\cong$ 53 emu/g) in the case of sodium hydroxide. Magnetic particle sizes were calculated by fitting to the Langevin function and found to be around 12 nm. Hydrodynamic particle diameters measured with dynamic light scattering technique were consistent with the particles sizes calculated from XRD and magnetic data.

References:

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UV Photopatterning using Phosphonate Self-assembled Monolayers

Qi Ya[1], Shu-Qing Sun[1]

[1]National Center for Nanoscience and Technology, China, Beijing 100080, P. R. China

*E-mail: yaq@nanoctr.cn

Keywords: Self-Assembled Monolayers, Phosphonate, Photolysis, UV Photopatterning

Abstract: Self-assembled monolayers (SAMs) have received significant interest for fundamental studies in wetting, adhesion, lubrication, and corrosion. Furthermore, the introduction of patterning has widened their application, for example, for selective metal deposition, site-specific colloidal attachment, biological immobilization, as etch resists, and potential templates for "lab-on-a-chip" systems. Many methodologies for patterning SAMs have been investigated with the most promising being microcontact printing and photolithography. These are both capable of producing complex patterns, with high spatial resolution, and more importantly offer "parallel" processability. However, photolithography of SAMs normally requires short wavelengths (< 254 nm) for efficient patterning, and these harsh conditions are often associated with nonspecific photodegradation, ozone induced damage, and a poorly defined surface[1].

Surface modification using light is one of the most powerful methods for controlling the physical and chemical properties of functionalized surfaces. By designing the SAMs simply based on the protection of the CO_2H as the ortho-nitrobenzyl (Fig. 1), [2] we can selecte to use longer wavelength UV light (365 nm) for photopatterning of phosphonate SAMs.

In this paper, we designed, synthesized novel phosphonic acid derivatives (with photoactive group) and prepared SAMs by absorbing the phosphonic acid to TiO_2/Ti substrate. The SAMs can be modified using soft UV irradiation to yield CO_2H functionalized surfaces (Fig. 1). Various surface properties of phosphonate TiO_2/Ti SAMs, such as hydrophobicity, surface energy, adhesion, and friction, are evaluated by contact angle (CA) measurements, atomic force microscopy (AFM), friction force microscopy (FFM), and x-ray photoelectron spectroscopy (XPS).